UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/485,325	05/22/2000	JUERGEN HAHN	10191/1295	1777

26646	7590	09/10/2004

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EXAMINER
STOCK JR, GORDON J

ART UNIT	PAPER NUMBER
2877	

DATE MAILED: 09/10/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

	Application No.	Applicant(s)
Office Action Summary	09/485,325	HAHN ET AL.
	Examiner	Art Unit	
	Gordon J Stock	2877	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) FROM
THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on <u>*26 July 2004*</u>.

2a)☐ This action is **FINAL**.   2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *9-14 and 16* is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *9-14 and 16* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☐ All   b)☐ Some * c)☐ None of:

      1.☐ Certified copies of the priority documents have been received.

      2.☐ Certified copies of the priority documents have been received in Application No. _____.

      3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
    Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413)
    Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Specification

1   The specification is objected to for the following: the phrase, "analyzer 5.7," of line 11

of page 5 should read –analyzer 5.4--. Correction is required.

Claim Rejections - 35 USC § 103

2.   The text of those sections of Title 35, U.S. Code not included in this action can be found

in a prior Office action.

3.   **Claims 9, 10, 14, and 16** are rejected under 35 U.S.C. 103(a) as being unpatentable over

Finarov (5,764,365) in evidence of **Finarov (5,333,052)** and in view of **Aspnes (3,985,447).**

As to **claim 9**, Finarov discloses a measurement apparatus comprising:

a light source emitting a beam (Fig. 5c, **120, 130, 132**; col. 7, lines 9-67); a transmitting optical

system conveying the beam to an incidence point on the substrate (Fig. 5b, **100, 150, 154**; col. 7,

lines 24-58); a photodetector device (Fig. 5c, **186,170,172, 198**); a receiving optical system

conveying the reflected beam to the photodetector device (Fig. 5c, **156, 152, 102**; col. 7, lines 35-

37; col. 8, lines 46-64); the receiving optical system including an analyzer (Fig. 5c, **160**); an

evaluation device, a data processor (col. 11, lines 19-20); an angle measurement device

calculating an angle of the reflected beam at the incidence point (Fig. 5c, **152, 194, 196, and 198**;

col. 10, lines 65-67; col. 11, lines 1-6); the polarization direction of the beam and of the analyzer

being modified in time relative to one another (Fig. 5b, **124 and 140**; Fig. 5c, **160 and 162**).

As for sensing versus calculating an angle, an angle is calculated from a light ray that

constitutes an angle comprising the detected ray and a reference ray such as the incident ray or a

reference line such as a normal to the surface of the substrate; thereby, if an angle is calculated it

must be sensed in order to perform the calculation.

Finarov is silent concerning the determination of the film thickness as a function of the

sensed angle and the intensity changes. However, Finarov implies the film thickness is a function

of the sensed angle and intensity changes, for ellipsometric measurements comprise measuring

changes in polarization of light by reflectance and ,subsequently, from amplitude and phase

changes. And Aspnes in a measurement of thin films states the dependence of amplitude and

phase on angles, intensities, and reflectances (col. 4, lines 15-67; col. 5, lines 1-65). Further in

evidence Finarov (5,333,052) demonstrates relations of the variables in thickness measurements

(cols. 5-7). Therefore, it would be obvious to one skilled in the art at the time that the invention

was made that film thickness would be determined as a function of intensity changes and angles,

for Finarov's system measures amplitude and phase changes to determine thickness which are

proportional to an angle and intensity.

As for the tangential plane not intersecting the substrate in an area of incidence, Finarov

demonstrates that the angle measurement is relative to a tangential plane, a plane substantially

parallel to the plane of the substrate, suggested by Fig. 5a; whereas, the tangential plane

comprises the dotted line that is perpendicular to the line normal to the plane of the substrate. In

addition, it is well-known that angles are defined trigonometrically in terms of a right triangle

such as a right triangle formed by two lines that comprise the angle, θ of Fig. 5a, and a third line

that is parallel to the plane of the substrate and perpendicular to the normal to the substrate to

form a 90 degree angle. Whereas, in Aspnes Fig. 1 the right triangle comprising angle φ would

have one side perpendicular to N to form a right angle. Therefore, it would be obvious to one

skilled in the art at the time that the angle θ was measured relative to a tangential plane that does not intersect the substrate for the angle is relative to a plane parallel to the substrate as in Fig. 5a and that angles are defined trigonometrically by a right triangle that would comprise a side in a plane parallel to the plane of the substrate.

As to **claim 10**, Finarov discloses everything as above (see **claim 9**), in addition, Finarov discloses the angle measurement device including a photodetector unit that is position-sensitive in at least one of an X and Y direction (col. 11, lines 1-6) with an angle of reflection being calculated from position data and distance data with an evaluation stage (col. 11, lines 7-21).

As to **claim 14**, Finarov discloses everything as above (see **claim 9**). In addition, Finarov discloses a converging lens arranged in front of the photodetector device (Fig. 5c, **168**).

As to **claim 16**, Finarov discloses everything as above (see **claim 9**). In addition, Finarov discloses the transmitting optical system including a polarizer (Fig. 5b, **124**) and a quarter wave plate (Fig. 5b, **122**) in a beam path of the beam. Finarov discloses the polarizer and the analyzer being arranged in rotationally driven fashion about an axis normal to a surface of the one of the polarizer and the analyzer; whereas, Finarov discloses "the polarizer having associated therewith motor drives (Fig. 5b, **140**). Although, not shown, motor drives typically operate with precise angular encoders. (col. 8, lines 25-28)." In addition, Finarov discloses the analyzer being similar to the polarizer (col. 8, lines 55-57) with a motor (Fig. 5c, **162**).

4.   Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Finarov (5,764,365)** in evidence of **Finarov (5,333,052)** and in view of **Aspnes (3,985,447)** and **Gold et al. (4,999,014)**.

As to **claim 11**, Finarov discloses a measurement apparatus comprising:

a light source emitting a beam (Fig. 3; 30); a transmitting optical system conveying the

beam to an incidence point on the substrate (Fig. 3, **32, 34, and 82**; col. 6, lines 20-40); a

photodetector device (Fig. 3, **38**) a receiving optical system conveying the reflected beam to the

photodetector device (Fig. 3, **36, 76-79**; col. 5, lines 60-67); and the receiving optical system

including an analyzer (Fig. 3, **36**). Though Finarov is silent concerning an evaluation device in

Figs. 2-3, he teaches an evaluation device, a processor, in another embodiment (col. 11, lines 19-

20), therefore, it would be obvious to one skilled in the art to have the ellipsometer comprise an

evaluation device in order to process the data gathered. Figure 5b demonstrates that the

polarization direction of the beam and of the analyzer would be modified in time relative to one

another (Fig. 5b, **124** and **140**; Fig. 5c, **160** and **162**).

As for an angle of reflection being calculated from position data and distance data, the

systems of Figs. 2 and 3 assume the reflection angle is equal to the incident angle whereas the

surface of the sample is flat. And the incidence angle is determined from the position and

distances of the components of the system such as the position of the deflection mirror (col. 5,

lines 20-35).

For the embodiments of Figs. 2 and 3, Finarov is silent concerning an angle measurement

device. However, he teaches using an angle measurement device in an ellipsometric device that

is position-sensitive in at least one of an x and y direction in order to make certain of the correct

incidence angle (col. 10, lines 60-65; col. 11, lines 1-10). Therefore, it would be obvious to one

skilled in the art to have the embodiment of Fig. 3 comprise an angle measurement device that is

position sensitive in at least one direction in order to make certain the incidence angle

predetermined is the actual angle produced by measuring it.

As for sensing versus calculating an angle, an angle is calculated from a light ray that

constitutes an angle comprising the detected ray and a reference ray such as the incident ray or a

reference line such as a normal to the surface of the substrate; thereby, if it an angle is calculated

it must be sensed in order to perform the calculation.

Finarov is silent concerning the determination of the film thickness as a function of the

sensed angle and the intensity changes. However, Finarov implies the film thickness is a function

of the sensed angle and intensity changes, for ellipsometric measurements comprise measuring

changes in polarization of light by reflectance and ,subsequently, from amplitude and phase

changes. And Aspnes in a measurement of thin films states the dependence of amplitude and

phase on angles, intensities, and reflectances (col. 4, lines 15-67; col. 5, lines 1-65). Further in

evidence Finarov (5,333,052) demonstrates relations of the variables in thickness measurements

(cols. 5-7). Therefore, it would be obvious to one skilled in the art at the time that the invention

was made that film thickness would be determined as a function of intensity changes and angles,

for Finarov's system measures amplitude and phase changes to determine thickness which are

proportional to an angle and intensity.

As for the tangential plane not intersecting the substrate in an area of incidence, Finarov

demonstrates that the angle measurement is relative to a tangential plane, a plane substantially

parallel to the plane of the substrate, suggested by Fig. 5a; whereas, the tangential plane

comprises the dotted line that is perpendicular to the line normal to the plane of the substrate. In

addition, it is well-known that angles are defined trigonometrically in terms of a right triangle

such as a right triangle formed by two lines that comprise the angle, θ of Fig. 5a, and a third line

that is parallel to the plane of the substrate and perpendicular to the normal to the substrate to

form a 90 degree angle. Whereas, in Aspnes Fig. 1 the right triangle comprising angle φ would

have one side perpendicular to N to form a right angle. Therefore, it would be obvious to one

skilled in the art at the time that the angle θ was measured relative to a tangential plane that does

not intersect the substrate for the angle is relative to a plane parallel to the substrate as in Fig. 5a

and that angles are defined trigonometrically by a right triangle that would comprise a side in a

plane parallel to the plane of the substrate.

As for the same photodetector sensing intensity changes, see previous paragraph above.

In addition, the photodetector 38 of Fig. 3 would sense position data, for a predetermined

incident angle is set; thereby, the position data would be sensed, for there is a preset incidence

angle. In addition, Gold in an apparatus for measuring thickness of thin films teaches a detector

that measures intensity changes and positional data, the positional data as a function of angle of

incidence (col. 6, lines 9-40), and Gold determining changes in reflectivity (Figs. 4a-c) suggest

determining intensity changes. It would be obvious to one skilled in the art at the time the

invention was made to have the apparatus comprise a photodetector sensing both intensity

changes and position data to minimize the cost through the use of fewer photodetectors.

5.   **Claims 12-13** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Finarov**

(5,764,365) in evidence of **Finarov (5,333,052)** and in view of **Aspnes (3,985,447)** and further

in view of **Tokuhashi et al. (5,838,432).**

As for **claim 12**, Finarov in evidence of Finarov (5,333,052) and in view of Aspnes

discloses everything as above (see **claim 9**). Finarov is silent concerning the photodetector unit

including two position-sensitive photodetectors whereas the angle is calculated based on

differing positions of the beam on the two position-sensitive photodetectors. Tokuhashi in an

angle detection apparatus teaches utilizing two one-dimensional PSD whereas the angle is

calculated based on the beam positions on the photodetectors and that one dimensional

photodetectors are cheaper than two dimensional psd's (col. 14, lines 5-35). Therefore, it would

be obvious to one skilled in the art to have the apparatus comprise two one-dimensional psd's

wherein the angle is calculated based on the beam positions on the photodetectors rather than one

two-dimensional psd, for one dimensional psd's are much cheaper than two-dimensional psd's.

As for **claim 13**, Finarov in evidence of Finarov (5,333,052) and in view of Aspnes and

Tokuhashi disclose everything as above (see **claim 12**). In addition, Finarov discloses a

beamsplitter arranged in the beam path of the reflected beam in front of the psd (Fig. 5c, **194**).

However, they are silent concerning the arrangement of the beamsplitter with the two one-

dimensional psd's. However, it would be obvious to one having ordinary skill in the art to

arrange the beamsplitter and the two photodetectors in order for the two photodetectors to

receive the partial beam of the reflected beam from the beamsplitter, since it has been held that

rearranging parts of an invention involves only routine skill in the art. *In re Japikse, 86 USPQ*

70.

Response to Arguments

6.   Applicant's arguments, see Remarks, filed July 26, 2004, with respect to the

rejection(s)of claim(s) 9, 10, 12-14, and 16 under 35 U.S.C. 112 first paragraph in action dated

February 11, 2004 have been fully considered and are persuasive. Therefore, the rejection and

objection to the drawings have been withdrawn.

In regards to the remarks of July 26, 2004 with respect to the rejection of claims 9-14,

and 16 under 35 U.S.C. 103(a) in regards to the Examiner's use of focal plane as tangential plane

Examiner finds arguments of applicant persuasive. However, upon further consideration of

Finarov (5,764,365) and **Aspnes (3,985,447)** the rejection of the claims under 35 U.S.C. 103(a)

remain. See above. Specifically, in regards to the tangential plane that does not intersect the

substrate, as stated above Finarov demonstrates that the angle measurement is relative to a

tangential plane, a plane substantially parallel to the plane of the substrate, suggested by Fig. 5a;

whereas, the tangential plane comprises the dotted line that is perpendicular to the line normal to

the plane of the substrate. In addition, it is well-known that angles are defined trigonometrically

in terms of a right triangle such as a right triangle formed by two lines that comprise the angle, θ

of Fig. 5a, and a third line that is parallel to the plane of the substrate and perpendicular to the

normal to the substrate to form a 90 degree angle. Whereas, in Aspnes Fig. 1 the right triangle

comprising angle ϕ would have one side perpendicular to N to form a right angle. Therefore, it

would be obvious to one skilled in the art at the time that the angle θ was measured relative to a

tangential plane that does not intersect the substrate for the angle is relative to a plane parallel to

the substrate as in Fig. 5a and that angles are defined trigonometrically by a right triangle that

would comprise a side in a plane parallel to the plane of the substrate.

Fax/Telephone Numbers

If the applicant wishes to send a fax dealing with either a proposed amendment or a

discussion with a phone interview, then the fax should:

1) Contain either a statement "DRAFT" or "PROPOSED AMENDMENT" on the fax

cover sheet; and

2) Should be unsigned by the attorney or agent.

This will ensure that it will not be entered into the case and will be forwarded to the examiner as

quickly as possible.

Papers related to the application may be submitted to Group 2800 by Fax transmission.
Papers should be faxed to Group 2800 via the PTO Fax machine located in Crystal Plaza 4. The
form of such papers must conform to the notice published in the Official Gazette, 1096 OG 30
(November 15, 1989). The CP4 Fax Machine number is: **(703) 872-9306**

Any inquiry concerning this communication or earlier communications from the examiner

should be directed to Gordon J. Stock whose telephone number is (571) 272-2431.

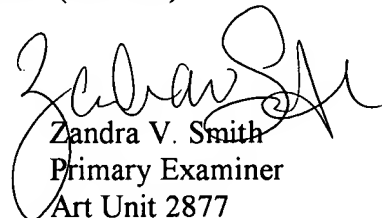The examiner can normally be reached on Monday-Friday, 10:00 a.m. - 6:30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Gregory J. Toatley, Jr., can be reached at 571-272-2800 ext 77.

Information regarding the status of an application may be obtained from the Patent

Application Information Retrieval (PAIR) system. Status information for published applications

may be obtained from either Private PAIR or Public PAIR. Status information for unpublished

applications is available through Private PAIR only. For more information about the PAIR

system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private Pair

system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

gs
August 31, 2004

Zandra V. Smith
Primary Examiner
Art Unit 2877